



GIS Screening Tool:

Cumulative Risk for Underground Storage Tanks

**Frank Harjo
Cherokee Nation
Inter-Tribal Environmental Council
UST Program**

ITEC Overview

Located in Tahlequah, Oklahoma

42 Member Tribes in Oklahoma, New Mexico,
and Texas

Provide Technical Services and Support

ITEC Programs:

Clean Air, Superfund, RCRA Solid and
Hazardous Waste, Brownfields, General
Assistance Program, UST

What's the problem?

Leaking Underground Storage Tanks (LUST):

- ✓ Adversely effect human health
- ✓ Adversely impact the environment
- ✓ Contaminate natural resources
- ✓ Remediation costs

Currently, there is no system used inspect those sites that pose the greatest potential to leak and impact our natural resources.

Associating Risk with UST's

Risk = Vulnerability (UST) + Impact (GIS Data)

Vulnerability – component of the UST System

Impact – Digital Data Sets

Determine degree of risk for each set of criteria
on a 1-5 scale, 1 is low/minimal and 5 is high/max

Associating Risk with UST's

Each set of criteria contains:

uncertainties, assumptions, other info

Professional judgments

Database reference & dated changes

Current literature & reference to env. law

More than 75 pieces of criteria are used in analysis

ITEC UST Criteria

Example:

UST Materials of Construction (1-5)

1 = Double & Triple walled Fiberglass

2 = STI-P3, FPR & Urethane coated

3 = Single Walled Fiberglass

4 = Steel w/ cathodic protection

5 = Steel

Leak Detection Records for 12 Months

Yes = 1

No = 5

Overall Criteria

Develop 5 categories or areas of concern for individual criteria

- ✓ UST Facility
- ✓ Physical UST Criteria
- ✓ Compliance (Operational & Maintenance)
- ✓ Landscape (Dr. Gerald Carney)
- ✓ Community (Dr. Gerald Carney)

ITEC UST Criteria

Facility Criteria (7):

- Total Number of Dispensers
- Total Number of UST's
- Age of Facility
- Facility Condition
- Facility Status
- Condition of Vent Pipes
- Site History Release

Compliance Criteria (8):

- ITEC UST Owner/Operator
- Leak detection records for 12 mo.
- Annual Maintenance/ Calibration
- Records & Paperwork complete
- UST Operating procedures
- Insurance
- Release reported past 12 mo
- Meets EPA compliance

Physical UST Characteristics (10):

- Tank Status
- New or Upgraded UST System
- Leak detection present (operational)
- Type of UST pumping System
- Piping Materials of construction
- Cathodic Protection (if applicable)
- UST Materials of Construction
- Type of Overfill device
- Age of UST
- Type of Spill containment

Landscape & Community Criteria

Landscape Criteria (24):

- Soil Permeability/ Porosity
- Aquifer Geology
- Distance to Surface Water
- Surface Water Shoreline
- Percent area covered by Surface Water
- Wetlands
- Surface water flow
- Annual Rainfall
- EPA Permitted facilities
- 100 yr floodplain
- 500 yr floodplain
- Public water supply
- Soil Profile
 - Engineering properties
- Natural Spring
- Private Well data
- Geology profile
- Depth to saturated zone

Community Criteria (26):

- Population Density
- Population under age 7
- Population over age 55
- Population under age 1
- Minority Population
- Road Density per square mile
- Unified Watershed Assessment
- Wildlife habitat
- Landuse Quality ranking
- Chemical release to air (TRI)
- Chemical release to land (TRI)
- Toxicity weighted release to air
- Toxicity weighted release to water
- Surface Water use
- Non-attainment area
- Health data
 - e.g. cancer, birth defects, disease rate
- NPL sites
- Schools & daycares
- Urban vs Rural area
- Other IUST sites

Goal & Solution to the Problem

- Prioritize UST sites that are most vulnerable
- Maximize Resources
- Decision Making tool

Utilize Geographic Information Systems (GIS)

Powerful Analysis tool

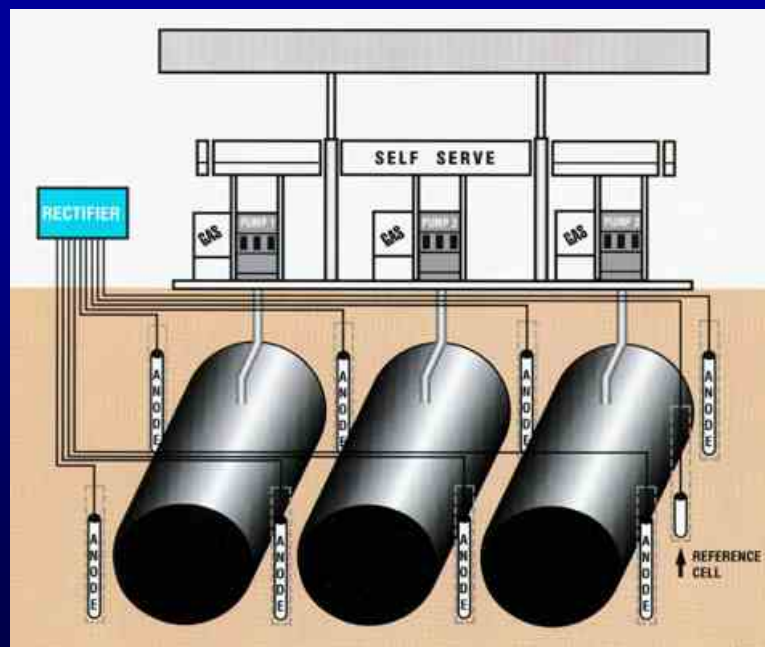
Spatial Relationships

Why Priority Ranking?



UST Failure

**Not all UST facilities
are built the same**



Early GIS Issues

Multiple UST's at Facility

- Score each UST individually
- Worst UST score scenario for each facility

Some criteria more important than others?

- Ground Water and Surface Water
- Answer: Weigh?

Developing the Tool

GIS tool – Goal is to utilize the tool in two ways

UST priority ranking tool –

Inspect those UST sites that present a higher risk to human health and environment

UST planning tool –

Determine if future UST site is in high risk area and advise on safeguards needed

Project Overview

ITEC UST Program:

- GPS UST locations and Monitoring Well Markers
- 21 ITEC UST Facilities in Oklahoma
- 63 Underground Storage Tanks
- Gather Data from EPA and ITEC Databases

In the Field

GIS UST Inspection Form:

- Criteria in system
- Standard Form
- GIS Format
- Process Time
- Update/Download
- Easy to Use



Arcpad UST Inspection Form

Example.apm - ArcPad

ITEC UST Inspection Form

General Information | UST Information | UST Structure | UST Struc...

Name of Tribe: Cherokee

EPA Facility ID#: 59

Facility Name: OutPost #1

Facility Address: 17699 S. Muskogee

Date of UST Inspection: 1/12/2006

Name of UST Inspector: Robert Largent

UST ID#: 0004

OK Cancel

Map showing locations in Oklahoma, including:

- Kanza Travel Plaza
- Woodbridge Market
- Ft. Oakland Trading Post
- Otoe Trading Post
- Pawnee Nation Trading Post
- Pawnee Nation Travel Plaza
- Iowa Tribe Mini Mart
- Creek Nation Travel Plaza
- OutPost #1
- Seminole Nation Travel Plaza
- Absentee Shawnee Tribal Store
- Kiowa Smoky Shop
- Apache Tribal Store
- Vehicle Maintenance Facility
- River Mist
- Stolee Oil & Gas

0km 433.72km 867.43km 1:1986365

35°51'48"N 94°59'26"W 1:1986365 V

start Inter-Tribal Environ... Microsoft PowerPoint ... Output Example.apm - ArcPad Cherokee - Windows ... 3:08 PM

In the Office

Step 1: Download the Form

Desktop GIS:

Step 2: Process Data: Field Data + Standard Data

Step 3: Using pre-determined criteria setup, data flows through automated GIS process through the 75 pieces of criteria

How it Works

Using AML (Arc Macro Language) scripts in ArcInfo Workstation...automated analysis

Creates buffer from lat/long of UST based on defined radius

Clips other datasets, Scores 1-5 based on pre-determined criteria

Records results (Raw Data & 1-5 score) in INFO table

Web Prioritization Overview

Inter-Tribal Environmental Council - ITEC UST Program

File Edit View Favorites Tools Help

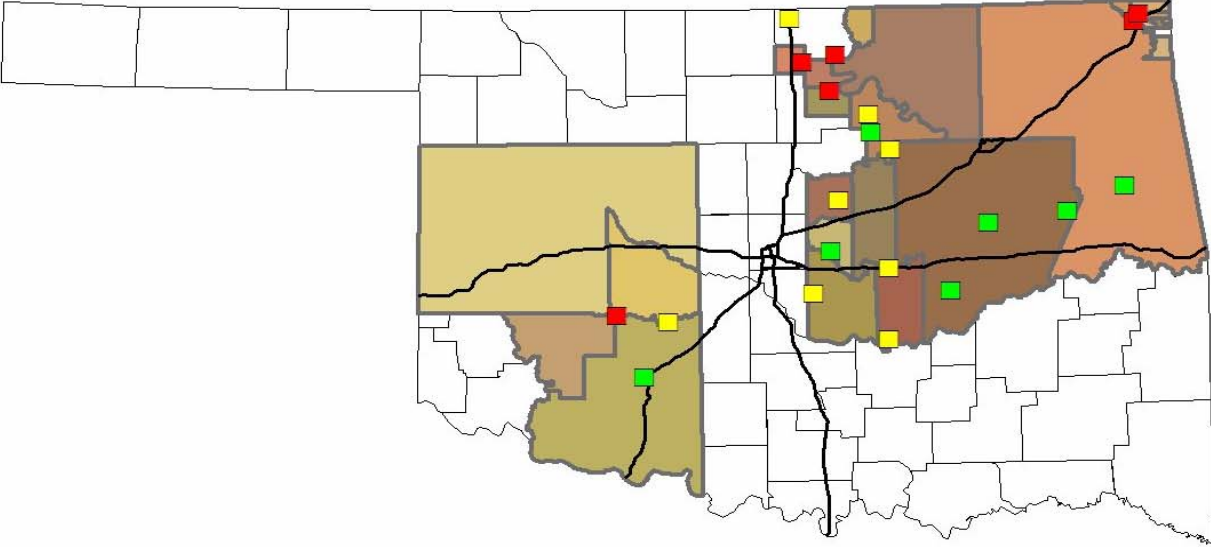
Back Forward Stop Home Search Favorites Print Mail News RSS Feeds

Address <http://cncp/website/Beta/viewer.htm> Go Links

Google Search Check AutoLink AutoFill Options

Search Web Search

Inter-Tribal Environmental Council



Map created with ArcIMS - Copyright (C) 1992-2006 ESRI Inc.

0 131 Miles

Layers

- Criteria
- Vector Data
- ☐ UST Compliance Criteria
- ☐ Facility Criteria
- ☐ Landscape Criteria
- ☐ Community Criteria
- ☒ ITEC UST Priority
- ☒ Oklahoma_Inter
- ☒ ITEC Tribal Boundaries
- ☒ ITEC_city
- ☒ 25mile_buff
- ☒ ok_countys
- ☒ ITEC_overall
- ☒ Caddo
- ☒ Cherokee
- ☒ Cleveland
- ☒ Comanche
- ☒ Creek
- ☒ Hughes
- ☒ Kay
- ☒ Lincoln
- ☒ Muskogee
- ☒ Noble
- ☒ Okmulgee
- ☒ Ottawa
- ☒ Pawnee
- ☒ Seminole

Refresh Map

Zoom In

Map: 670119.88, 2174416.57 -- Image: 964, 26 -- ScaleFactor: 2399.1558024415117

start Inter-Tribal Environ... Microsoft PowerPoint ... Local intranet 2:41 PM

Site with 1/4 Mile Radius

Inter-Tribal Environmental Council - ITEC UST Program

File Edit View Favorites Tools Help


Back Forward Stop Home Search Favorites

Address http://cnp/website/Beta/viewer.htm Go Links

Google Search Check AutoLink AutoFill Options

Search Web Bookmarks Mail Fantasy Sports Basketball Football NCAA Football Games Music

Inter-Tribal Environmental Council



Map created with ArcIMS - Copyright (C) 1992-2006 ESRI Inc.

0.3152 Miles

Layers

- Criteria
 - ☐ UST Compliance Criteria
 - ☐ Facility Criteria
 - ☐ Landscape Criteria
 - ☐ Community Criteria
 - ☒ ITEC UST Priority
 - ☒ Oklahoma_Inter
 - ☒ ITEC Tribal Boundaries
 - ☒ ITEC_city
 - ☒ 25mile_buff
 - ☒ ok_countys
 - ☒ ITEC_overall
 - ☒ Caddo
 - ☒ Cherokee
 - ☒ Cleveland
 - ☒ Comanche
 - ☒ Creek
 - ☒ Hughes
 - ☒ Kay
 - ☒ Lincoln
 - ☒ Muskogee
 - ☒ Noble
 - ☒ Okmulgee
 - ☒ Ottawa
 - ☒ Pawnee
 - ☒ Seminole
- Vector Data

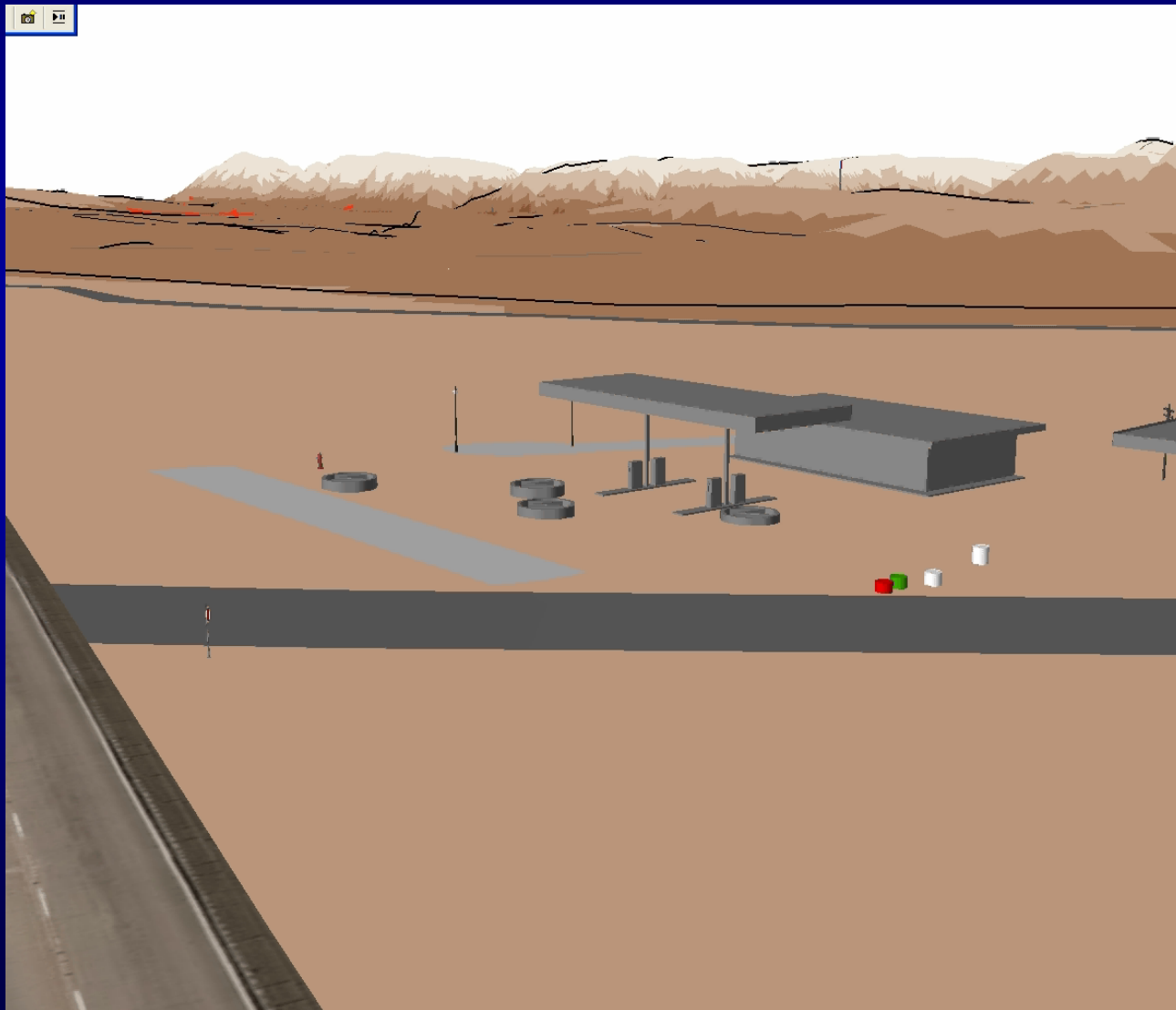
Refresh Map

Zoom In

Map: 1185549.64, 1649848.9 -- Image: 641, 24 -- ScaleFactor: 5.779140026213655

start Inter-Tribal Environ... Microsoft PowerPoint ... Local intranet 2:48 PM

UST 3D Model

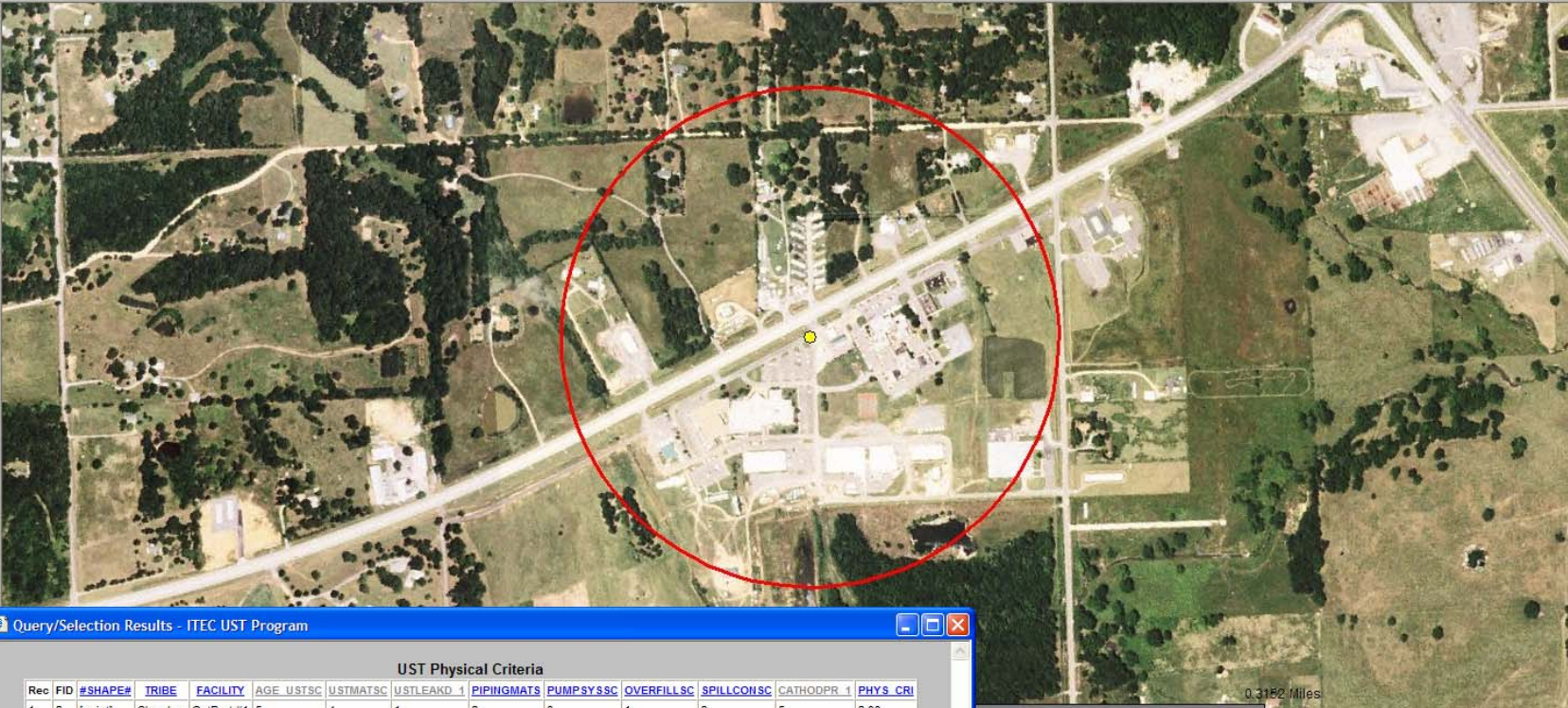


Site with UST Physical Criteria Screen

Inter-Tribal Environmental Council - ITEC UST Program

Address: http://cneep/website/Beta/viewer.htm

Inter-Tribal Environmental Council



Layers

- ☒ Criteria
 - ☒ UST Physical Criteria
- ☐ Vector Data
 - ☐ UST Compliance Criteria
 - ☐ Facility Criteria
 - ☐ Landscape Criteria
 - ☐ Community Criteria
 - ☒ ITEC UST Priority
 - ☒ Oklahoma_Inter
 - ☒ ITEC Tribal Boundaries
 - ☒ ITEC_city
 - ☒ 25mile_buff
 - ☒ ok_countys
 - ☒ ITEC_overall
 - ☒ Caddo
 - ☒ Cherokee
 - ☒ Cleveland
 - ☒ Comanche
 - ☒ Creek
 - ☒ Hughes
 - ☒ Kay
 - ☒ Lincoln
 - ☒ Muskogee
 - ☒ Noble
 - ☒ Okmulgee
 - ☒ Ottawa
 - ☒ Pawnee
 - ☒ Seminole

Refresh Map

Query/Selection Results - ITEC UST Program

Rec	FID	#SHAPE#	TRIBE	FACILITY	AGE	USTSC	USTMATSC	USTLEAKD	PIPINGMATS	PUMPSYS	OVERFILL	SPILLCON	CATHODPR	PHYS_CRI
1	2	[point]	Cherokee	OutPost #1	5	4	1	2	3	1	2	5	2.88	

Map: 1184047.06, 1649490.6 -- Image: 381, 86 -- ScaleFactor: 5.779140026213655

start Inter-Tribal Environ... Query/Selection Resu... Microsoft PowerPoint ... 2:54 PM

Cumulative Risk Results

Low

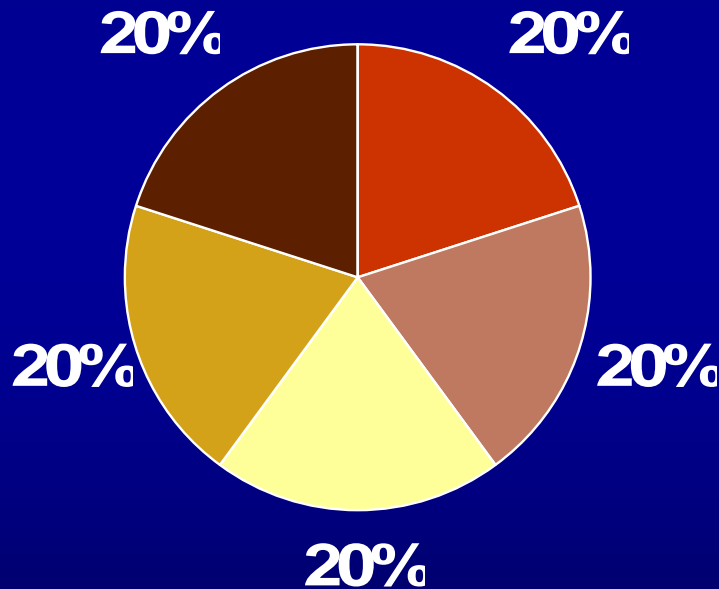
Station A	1.75
Station B	2.57
Station C	2.66
Station D	2.68
Station E	2.82
Station F	2.91
Station G	2.95






Highest

Station Z	3.62
-----------	------

Cumulative Results

Cumulative Results for each Category



-  **Facility Criteria**
-  **UST Physical Criteria**
-  **Compliance Criteria**
-  **Landscape Criteria**
-  **Community Criteria**

Future Online Documentation

Inter-Tribal Environmental Council --> Home Microsoft Internet Explorer

File Edit View Favorites Tools Help Links Cherokee Home ESRI - The GIS Software Leader ESRI Support Center Home ESRI Training - Authorized Training Program Google

Address http://www.itecmembers.org/ Go

Back

ITEC

"...to protect the health of Native Americans, their natural resources, and their environment"

Inter-Tribal Environmental Council

Home Member Tribes Programs RTOC Calendar About Us Contact Us Resources

Cumulative Risk for Underground Storage Tanks

+Introduction

+Five Category

+Physical UST Characteristics

+Facility Criteria

+Compliance Criteria

+Landscape Criteria

+Community Criteria

Menu

Home

ITEC Programs

RTOC

Calendar

About Us

Contact Us

Resources

ITEC Conf.

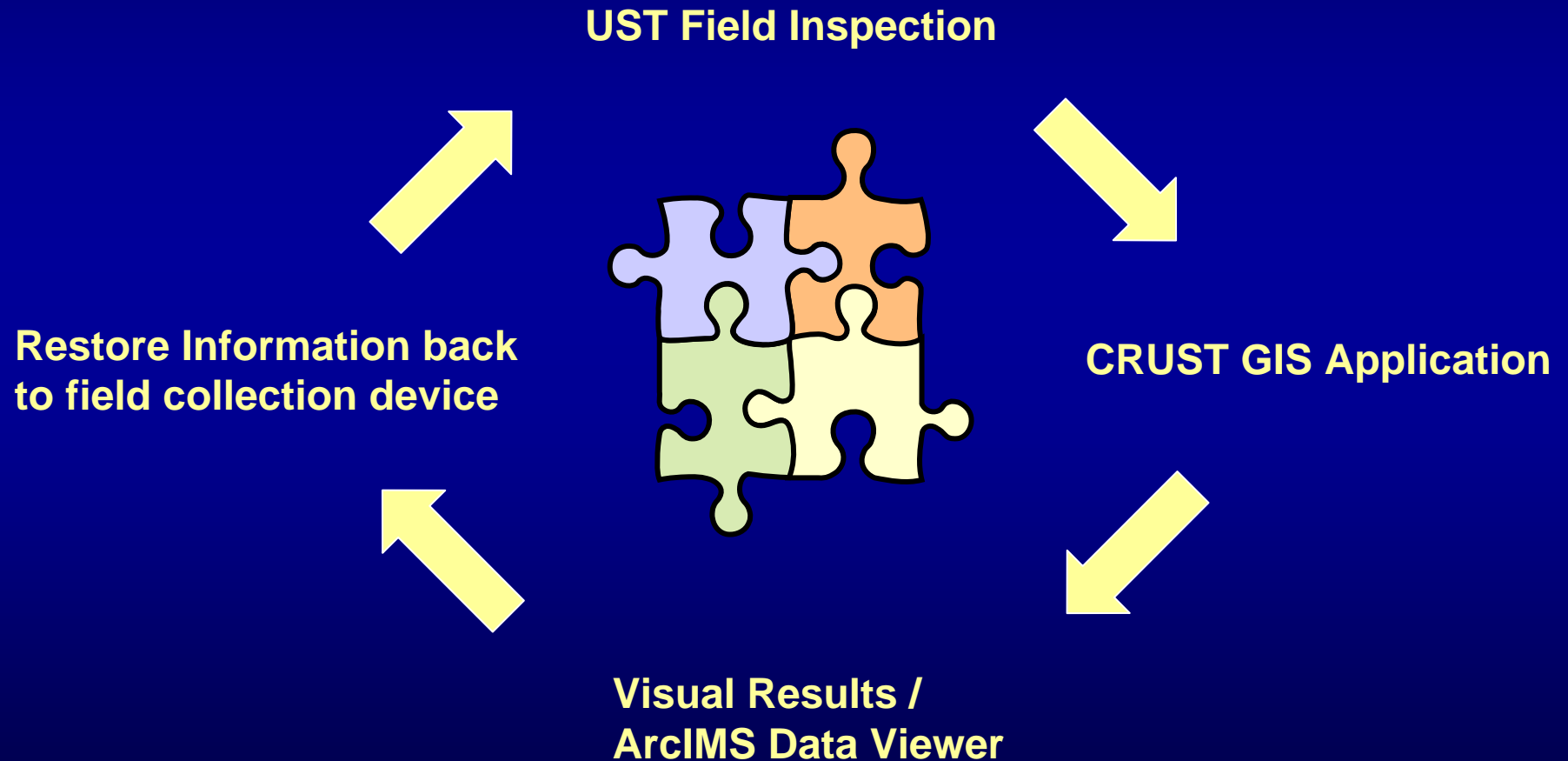
11th Annual Conference

SITE SPONSORED BY

bama-Quassarte Tribal Town, Caddo Tribe, Cheyenne/Arapaho Tribes, Cherokee Nation, Citizen Potawatomi Nation, Comanche Tribe,

Internet

UST Field Inspection Process



What Ends Up Happening...

- ✓ Prioritize UST Facilities
- ✓ Maximize ITEC UST Staff
- ✓ Predict where future UST leaks may occur
- ✓ Environmental Impact a leak will have on the area
- ✓ A planning tool to screen future UST sites
- ✓ Decision Making tool

Project Overview

Software Applications Used

ESRI Arcpad 6.03

ArcInfo 9.0

ArcIMS 9.0

Spatial Analyst Extension

3D Analyst Extension

Sketchup 5.0

What's Next...

- ✓ Full System implementation
- ✓ Complete Documentation
- ✓ WEB compatible application
- ✓ Integrate with other ITEC programs

Advantages of CRUST GIS

- Customizable to fit need / program
- Expanded to include large amounts of data
- Data available from multiple sources
- Process multiple data sets (saves time & money)
- User defined radius
- Instant results

Questions

Contact Information

Frank Harjo / Robert Largent
fharjo@cherokee.org
Inter-Tribal Environmental Council
P.O. Box 948
Tahlequah, OK 74464
918-458-5496

Dr. Gerald Carney
U.S. EPA Region 6
Dallas, Texas
214-665-6523

Special Thanks :
Jeff Danielson, EPA Region 6, GIS Support Team

ITEC Overview

22 Environmental Staff

12 Workstation Mobile Training Lab

2 ESRI Authorized Instructors

2 Trimble Certified Instructors



www.itecmembers.org

Trainings Offered:

GIS/GPS

Environmental Sampling

UST Owner/Operator

Water Sampling

Air & Brownfield's Workshops

